ABSTRACT

THESIS: Radiation Shielding and Protection by MCP-200 Alloy

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Radiation can be used to target specific parts of the body to treat cancer. Different forms of shielding material help to ensure that the radiation only reaches the targeted areas and does not damage healthy cells. Therefore, it is important to study how different materials interact with radiation.

There will be two methods of interaction that will be discussed. The first method of interaction is the attenuation of a radiation beam. When radiation passes through a material, the intensity of the beam decreases with thickness of the material. How quickly it decreases depends on the material and the energy of the beam. The attenuation of a beam of radiation is an exponentially decreasing function of thickness. The quantity that determines how fast radiation decreases in a medium is referred to as the attenuation coefficient. Measuring the attenuation coefficient allows one to determine how much radiation has passed through a material of given thickness.

The second method of interaction is referred to as buildup. The buildup of radiation is an increase in dosage of a radioactive sample due to Compton Scattering. Buildup is determined by the material the radiation beam is passing through and energy of the radiation beam, just as the

attenuation was. The quantity that determines how much the radiation beam's dosage has increased is referred to as the buildup factor. The buildup factor is multiplied by the exponentially decaying function (determined from the attenuation) to give a more complete equation for radiation. The buildup factor is greater than or equal to one. It can never be less than one, as this would imply that the buildup is decreasing the dosage. If the buildup factor is equal to one. Then this shows that there is no buildup of radiation in the material.

The goal of my research is to measure the attenuation coefficient (penetrating power) and the buildup factor of the alloy, MCP 200. Then, comparisons will be made to theoretical and computational research conducted on different materials from other papers. It was found that the buildup factor increased linearly with increasing material thickness, decreased with increasing photon energy, and increased with increasing attenuator to detector distance. It was reported in a paper that the buildup factor increased with increasing photon energy. Other papers reported that the buildup factor would first increase with increasing photon energy, reach a peak, and then begin decreasing.